

UNITED STATES DISTRICT COURT
DISTRICT OF MAINE

MARICAL, INC., et al.,)	
)	
Plaintiffs)	
)	
v.)	1:14-cv-00366-JDL
)	
COOKE AQUACULTURE INC., et al.,)	
)	
Defendants)	

RECOMMENDED DECISION ON CLAIM CONSTRUCTION

In this action, Plaintiffs and Counter-claim Defendants Marical Inc., Europharma AS, and Europharma Inc. Canada (“Plaintiffs”), allege that Defendants and Counter-claim Plaintiffs Cooke Aquaculture Inc., Cooke Aquaculture USA Inc., True North Salmon Co. Ltd., True North Salmon US Inc., True North Sales US Inc., and Salmones Cupquellan SA (“Defendants”), produce and import salmon raised by methods that infringe United States Patent No. 6,463,883 (Patent ‘883), United States Patent No. 6,475,792 (Patent ‘792), United States Patent No. 6,481,379 (Patent ‘379), and United States Patent No. 6,564,747 (Patent ‘747), which patents-in-suit teach methods for raising pre-adult anadromous fish. (Complaint, ECF No. 1.) In their counterclaim for declaratory judgment, Defendants seek a judgment of invalidity and non-infringement. (Answer and Counterclaims, ECF No. 16.)

The matter is before the Court on the issue of claim construction. Following a review of the record, and after consideration of the parties’ written and oral arguments, I recommend the Court construe the disputed claim terms as set forth herein.

BACKGROUND

The parties engage in salmon aquaculture, or aquafarming. Salmon are a species of anadromous fish. In the ordinary course of nature, anadromous fish are born in freshwater, migrate and adapt to seawater in the course of their growth cycle, and return to freshwater to spawn. Salmon aquaculture operations ordinarily raise salmon in freshwater holding tanks until the salmon begin the process of smoltification, at which time salmon smolts are transferred to seawater pens where they grow to harvest weight. Because seawater contains significantly greater concentrations of salts (ionic compounds) than freshwater, anadromous fish that are transferred directly from freshwater to seawater, without preparation, can experience osmotic stress. Osmotic stress can cause a high rate of fish mortality. Osmotic stress also can cause a period of morbidity during which the fish feed at a reduced rate, which prolongs the growth process and/or reduces the net weight at harvest.

Generally, the four patents-in-suit describe “methods, compositions and kits for improving the raising of pre-adult anadromous fish, or preparing pre-adult anadromous fish for transfer to seawater.”¹ (See Abstract of each patent.) The patents assert that proper preparation of the fish avoids or reduces osmotic stress, and thus improves the survival rate, reduces morbidity, and increases the rate at which the fish feed and gain weight following transfer to a seawater environment. The patented methods describe a process that purports to increase the expression and/or sensitivity of Polyvalent Cation Receptors (PVCR) in the fish and to increase the level of PVCR modulators in the serum of the fish, which methods prepare the fish for transfer to seawater.

¹ Three of the patents have a filing date of October 12, 2000. Patent ‘883 issued October 15, 2002. Patent ‘792 issued November 5, 2002. Patent ‘379 issued November 19, 2002. Patent ‘747 has a filing date of October 11, 2001, and issued May 20, 2003. In this recommended decision, citations to the three earlier patents are ordered according to their last three digits (i.e., ‘379, ‘792, ‘883), although this ordering is in reverse chronological order. Patent ‘747 is cited last to reflect its later application date.

The methods primarily involve the introduction to the freshwater environment of one or more PVCr modulators, such as magnesium and calcium in certain molar concentrations, and the use of a fish feed containing a sufficient amount of NaCl. (*See* Abstract, Background, and Summary of each patent.)

Plaintiffs allege that Defendants previously employed the patented methods at Defendants' facilities in Maine, Chile, New Brunswick, Newfoundland, Nova Scotia, and Spain, pursuant to a license that expired in 2008. (Complaint ¶ 30.) Plaintiffs further assert that Defendants continue to employ the patented methods without a license, in violation of the four patents-in-suit. (*Id.*, Counts I – IV.) Defendants contend they have not infringed any valid claim of the patents-in-suit, and they request a declaratory judgment of non-infringement and the invalidity of the patents. (Answer and Counterclaim at 9 – 11, 14 – 19.)

The parties maintain that terms used in the patents require construction before the merits of the claims, defenses, and counterclaims can be resolved.²

CLAIM CONSTRUCTION PRINCIPLES

The grant of a patent is the grant of a monopoly, in exchange for which monopoly the inventor is required to teach to others skilled in the art, in clear and precise language, how to practice the patented invention. 35 U.S.C. § 112; *Gen. Elec. Co. v. Wabash Appliance Corp.*, 304

² In addition to their positions at oral argument, the parties rely on the following: Defendants' Claim Construction Chart (ECF No. 63); Plaintiffs' Claim Construction Chart (ECF No. 64); Plaintiffs' Opening Claim Construction Brief (ECF No. 71); Defendants' Opening Claim Construction Brief (ECF No. 79) (sealed; a redacted, public version of Defendants' Opening Claim Construction Brief is available at ECF No. 78); Plaintiffs' Responsive Claim Construction Brief (ECF No. 87); Defendants' Rebuttal Brief (ECF No. 89); Plaintiffs' Reply Brief (ECF No. 90); Declaration of Steven H. Jury, Ph.D. (ECF No. 72); Declaration of Terrence M. Bradley, Ph.D. (ECF No. 76-6); Defendants' Brief Regarding Prior Licensing Agreements (ECF No. 106); and Plaintiffs' Brief Regarding Prior Licensing Agreements (ECF No. 108).

U.S. 364, 368 – 69 (1938). The requirement that the patentee teach the invention in clear terms has been referred to as the “definiteness requirement.” *Nautilus, Inc. v. Biosig Instr., Inc.*, 134 S. Ct. 2120, 2128 (2014). The definiteness requirement not only ensures that those skilled in the art will be able to practice the invention, but also provides notice of the scope of the patent. *Dow Chem. Co. v. Nova Chem. Corp.*, 803 F.3d 620, 630 (Fed. Cir. 2015).

To be definite, claim terms “must be precise enough to afford clear notice of what is claimed, thereby apprising the public of what is still open to them.” *Nautilus*, 134 S. Ct. at 2129 (internal quotation marks and bracket omitted). Without this requirement, patent applicants could employ ambiguous language to generate a “zone of uncertainty” about the scope of their invention, which uncertainty can discourage further innovation by others. *Id.* (quoting *United Carbon Co. v. Binney & Smith Co.*, 317 U.S. 228, 236 (1942)). In order to reconcile the “competing concerns,” the Patent Act requires “that a patent’s claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty.” *Id.* (recognizing that “absolute precision is unattainable”).

The initial step in a patent infringement action involves the construction of the language used in the patent to describe the claimed invention (so-called “claim construction”).³ *Wavetronix LLC v. EIS Elec. Integrated Sys.*, 573 F.3d 1343, 1355 (Fed. Cir. 2009). The construction of patent claims is a matter for the court to determine as a matter of law, though the construction of a claim term can have “evidentiary underpinnings” that require “subsidiary factfinding.” *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 838 (2015). Determination of the scope of a claim

³ “[A] patent claim is that ‘portion of the patent document that defines the scope of the patentee’s rights.’” *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 835 (2015) (quoting *Markman v. Westview Instr., Inc.*, 517 U.S. 370, 372 (1996)); *see also Gen. Elec. Co. v. Wabash Appliance Corp.*, 304 U.S. 364, 369 (1938) (“The claims measure the invention.”) (internal quotation marks omitted). Every patent must “conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.” 35 U.S.C. § 112.

involves “analysis of the whole document,” and can require reliance on expert testimony. *Nautilus*, 134 S. Ct. at 2130 (quoting *Markman v. Westview Instr., Inc.*, 517 U.S. 370, 389 (1996)).

Person of ordinary skill in the art (POSA)

“Claim construction seeks to ascribe the ‘ordinary and customary meaning’ to claim terms as they would be understood to a person of ordinary skill in the art at the time of invention.” *Secure Web Conference Corp. v. Microsoft Corp.*, No. 15-1321, 2016 WL 626492, at *2 (Fed. Cir. Feb. 17, 2016). “[T]he person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). To determine “the scope and meaning” that claim terms would have to a person of ordinary skill in the art, therefore, the court considers the words of the claims themselves, the broader patent specification that incorporates the claims, the prosecution history, and if necessary, any relevant extrinsic evidence.⁴ *Id.* at 1315 – 17; *Cioffi v. Google, Inc.*, No. 15-1194, 2015 WL 7254039, at *4 (Fed. Cir. Nov. 17, 2015).

Patent specification

A patent is “a fully integrated written instrument, consisting principally of a specification that concludes with the claims,” and “[f]or that reason, claims must be read in view of the specification.” *Phillips*, 415 F.3d at 1315 (internal quotation marks omitted). Always relevant

⁴ The claims, specification, and prosecution history are intrinsic evidence in the claims construction analysis. Expert testimony and treatises are types of extrinsic evidence. Regarding the use of extrinsic evidence, the Supreme Court has explained:

[S]ometimes, say when a written instrument uses technical words or phrases not commonly understood, those words may give rise to a factual dispute. If so, extrinsic evidence may help to establish a usage of trade or locality. And in that circumstance, the determination of the matter of fact will precede the function of construction.

Teva Pharm., 135 S. Ct. at 837 – 38.

and sometimes dispositive, the patent specification “is the single best guide to the meaning of a disputed term.” *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). “The importance of the specification in claim construction derives from the statutory requirement that the specification describe the claimed invention in ‘full, clear, concise, and exact terms.’” *Phillips*, 415 F.3d at 1316 (quoting 35 U.S.C. § 112(1)).

In some instances “the specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess.” *Id.* If so, “the inventor’s lexicography governs.” *Id.* For example, if in the specification the patentee has provided a special definition for a term that is different from the ordinary meaning of the term, the term should be construed in accordance with the special definition unless a contrary definition is apparent in a particular claim. *Id.* “However, a claim term is only given a special definition different from the term’s plain and ordinary meaning if the ‘patentee ... clearly set[s] forth a definition of the disputed claim term other than its plain and ordinary meaning.’” *Akamai Techs., Inc. v. Limelight Networks, Inc.*, 805 F.3d 1368, 1375 (Fed. Cir. 2015) (quoting *Thorner v. Sony Computer Entm’t Am., LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (citations omitted)).

Patent claims

Claims often instruct the reader on the meaning of disputed terms. *Phillips*, 415 F.3d at 1314. Because claim terms are generally used throughout a patent in a consistent manner, the use of a term in one claim can sometimes provide meaning in the context of another claim. *Id.* On the other hand, ordinarily different claims are understood to teach different embodiments of an invention (the so-called claim differentiation presumption).⁵ For instance, if a claim teaches a

⁵ Claim differentiation “is not a hard and fast rule and will be overcome by a contrary construction dictated by the written description or prosecution history.” *Seachange Int’l, Inc. v. C-COR, Inc.*, 413 F.3d 1361, 1369 (Fed. Cir. 2005).

version of the invention that is dependent on a particular limitation, process, or component, it may be inferred that the limitation, process, or component is not present in another claim lacking reference to it. *Id.* at 1314 – 15; *Liebel–Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004).

Prosecution history

“The prosecution history ... consists of the complete record of the proceedings before the PTO [Patent Office] and includes the prior art cited during the examination of the patent.” *Phillips*, 415 F.3d at 1317. This historical record “provides evidence of how the PTO and the inventor understood the patent” and one may discern meaning from the record the patentee created to explain the invention to the PTO, although the record “often lacks the clarity of the specification and thus is less useful for claim construction purposes.” *Id.*

Extrinsic evidence

Extrinsic evidence “consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises.” *Id.* (internal quotation marks omitted). Expert testimony “can be useful to a court for a variety of purposes, such as to provide background on the technology at issue, to explain how an invention works, to ensure that the court’s understanding ... is consistent with that of a person of skill in the art, or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field.” *Id.* at 1318. While extrinsic evidence can be of assistance, particularly to understanding the relevant art, it generally is not as useful to claims construction as the intrinsic record. *Id.* at 1317. Additionally, the Court must take care when relying on expert testimony given that the testimony was not presented to the PTO and thus is not part of the prosecution history. Expert

testimony should not be used to change the meaning of a patent that is meant to be a public record capable of teaching the invention without resort to extrinsic sources. *Id.* at 1318 – 19.

THE PERSON OF ORDINARY SKILL IN THE ART⁶

As a preliminary step in the claim construction process, the Court must determine the characteristics that define the person of ordinary skill in the art. According to Defendants, in this case, a person of ordinary skill in the art is a person who has (a) either a bachelor's degree in biology with five years of hatchery experience or a master's degree with hands-on hatchery experience, and (b) has managerial responsibility at a fish hatchery where anadromous fish are raised for transfer to seawater. (Defendants' Opening Brief at 11, PageID # 4743.) Plaintiffs contend that the person of ordinary skill must be familiar with the "molecular techniques described in the patents" (Plaintiffs' Responsive Brief at 5, PageID # 4818), and have "at least a master's degree in the biological sciences," and "several years of experience working in aquaculture," such as a "Freshwater Production Manager" at a commercial hatchery that raises anadromous fish. (Jury Declaration ¶ 15, ECF No. 72, PageID # 968.) Defendants argue that a person with understanding of the molecular techniques described in the patents is not a person of ordinary skill in the art, but rather a person of extraordinary skill. (Plaintiffs' Reply at 4 – 5, PageID # 4959 – 60.) Plaintiffs maintain that knowledge of molecular techniques is necessary because the patented methods require significant knowledge of statistics and knowledge of how to design biological studies. (*Id.* at 5, PageID # 4960.)

⁶ Defendants' Opening Brief at 11, ECF No. 79; Declaration of Terrence Bradley ¶ 17, ECF No. 76-6; Plaintiffs' Responsive Brief at 5, ECF No. 87; Declaration of Steven Jury ¶ 15, ECF No. 72.

As a general rule, the person of ordinary skill in the art is a person capable of practicing the invention as taught. 35 U.S.C. § 112(a).⁷ In this case, as explained further below, to practice the invention as taught, the person of ordinary skill in the art would have on-the-job experience at a fish hatchery that raises anadromous fish for transfer to seawater, including managerial experience, would understand the growth cycle of anadromous fish and the biological and chemical factors that produce osmotic stress in anadromous fish following transfer to seawater, and would have the requisite skill to conduct one or more tests to measure PVCR expression in the tissue of fish and to conduct one or more tests to measure PVCR modulator concentrations in fish blood. To achieve the requisite level of skill, the person would have to have significant hands-on experience, and, at a minimum, a bachelor's degree in the biological sciences.

After review of the record, therefore, I conclude that the person of ordinary skill in the art is a person with, at a minimum, a bachelor's degree in the biological sciences, whose educational background has been developed by managerial responsibility at a fish hatchery that raises anadromous fish for transfer to seawater, who understands the growth cycle of anadromous fish, who understand the biological and chemical factors that produce osmotic stress in anadromous fish following transfer to seawater, and who has sufficient skill to conduct one or more tests to measure PVCR expression in the tissue of fish and one or more tests to measure PVCR modulator concentrations in fish blood.⁸

⁷ Pursuant to 35 U.S.C. § 112(a):

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same,

⁸ The person is not required to have specialized skill in “designing” biological studies or conducting statistical analyses of data, because those skills are not required to practice the invention.

CLAIM CONSTRUCTION

A. Preamble Language⁹

The disputed claims begin with one of the following preambles:

“A method for preparing pre-adult anadromous fish for transfer from freshwater to seawater, comprising ...”

(Patent ‘379, claim 19; Patent ‘883, claim 11.)

“A method of [or for] preparing pre-adult salmon for transfer from freshwater to seawater, comprising ...”

(Patent ‘747, claim 22; ‘883, claim 23.)

“A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising ...”

(Patent ‘379, claim 13; Patent ‘792, claim 14.)

“A method of reducing mortality of pre-adult anadromous fish upon transfer from freshwater to seawater, comprising ...”

(Patent ‘747, claim 35.)

“A method of transferring a pre-adult anadromous fish from freshwater to seawater having a temperature of about 14 C. to about 19 C., comprising ...”

(Patent ‘747, claim 37.)

Preamble language, as a general rule, does not limit the scope of the invention that follows.

In particular, if the claim itself “defines a structurally complete invention ... and uses the preamble only to state a purpose or intended use for the invention,” the preamble should not be treated as a limitation on the scope of the invention.¹⁰ *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (quoting *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997)).

⁹ Plaintiffs’ Opening Brief at 41 – 42; Defendants’ Opening Brief at 43 – 45; Plaintiffs’ Responsive Brief at 30; Defendants’ Rebuttal Brief at 29 – 30; Plaintiffs’ Reply at 15; Defendants’ Reply at 14 – 15

¹⁰ Generally, if the preamble is limited to describing a purpose or intended use, treatment of the preamble as a limitation is a disadvantage for the inventor because the patent should protect the invention regardless of the use to which it is applied. *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 809 (Fed. Cir. 2002). Similarly, a preamble that merely “extol[s] the benefits or features of the claimed invention does not limit the claim scope.” *Id.*

However, “if [the preamble] recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim,” it limits the scope of the invention. *Id.* (internal quotation marks omitted). For example, if deletion of the preamble would not affect the structure or steps of the claimed invention, it is not limiting. *Id.* at 809. “Whether to treat a preamble as a limitation is a determination ‘resolved only on review of the entire patent to gain an understanding of what the inventors actually invented and intended to encompass by the claim.’” *Id.* at 808 (quoting *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1257 (Fed. Cir. 1989) (internal brackets and ellipses omitted)).

Defendants request a ruling that the preambles are not limiting; Plaintiffs assert that the phrases give meaning to the claims. A review of the patents reveals the preambles are in part limiting. Specifically, the preambles place the claim steps that follow in the essential context of preparing pre-adult anadromous fish or salmon for transfer to seawater. Although obvious, the fact that the methods are applied to pre-adult anadromous fish – i.e., that the fish are also present in the freshwater and are thereby adapted for transfer – is essential.

The preamble of claim 37 of Patent ‘747, however, which preamble describes the transfer of pre-adult anadromous fish to seawater with a temperature between 14 and 19 degrees Celsius, is not limiting. In this instance, deletion of the temperature factor would not change the essential steps of the method, which simply provide for keeping fish in freshwater to which is added at least one PVCR modulator and fish feed having the specified NaCl content by weight, followed by a transfer “to seawater.” The method thus is the same method prescribed for the other patented PVCR modulator / NaCl feed methods discussed herein. In other words, successful transfer to warmer seawater is merely a benefit or intended use of the patented method, and, therefore, is not a limitation on the claim. (Patent ‘747, col. 17, ll. 10 – 14.)

B. “Freshwater” and “Maintained”

The parties dispute the meaning of “freshwater” and whether the word “maintained” is sufficiently definite to describe a patentable process. These terms appear not only in the preambles, but also in the claims. For example:

“a) Adding magnesium and calcium to the freshwater”

(Patent ‘379, claim 13; Patent ‘792, claim 14.)

“b) Adding feed for fish consumption to the freshwater”

(Patent ‘792, claim 14.)

“The method of claim 22, wherein the pre-adult salmon are maintained in the freshwater ... until the pre-adult salmon are transferred to seawater.”

(Patent ‘747, claim 23.)

I. Freshwater¹¹

The parties propose the following construction of “freshwater”:

Plaintiffs’ construction	Defendants’ construction
Water that comes from a non-marine source, and which may include one or more additives (e.g., at least one PVCRC modulator). (ECF No. 64, PageID # 751)	Depending on the claim in question, either: Water that comes from, for example, a stream, river, ponds, public water supply, or from other non-marine sources having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium and NaCl. (ECF No. 63, PageID # 636) or

¹¹ Plaintiffs’ Opening Brief at 19; Declaration of Steven Jury ¶¶ 89 – 96; Defendants’ Opening Brief at 14; Declaration of Terrence Bradley ¶¶ 130 – 145; Plaintiffs’ Responsive Brief at 5; Defendants’ Rebuttal Brief at 20.

	<p>Water that comes from, for example, a stream, river, ponds, public water supply, or from other non-marine sources having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium and NaCl and to which at least one PVCR modulator has been added.</p> <p>(<i>Id.</i>, PageID # 640.)</p>
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The specifications of Patents ‘883 and ‘747 define “freshwater” as follows:

Water that comes from, for example, a stream, river, ponds, public water supply, or from other non-marine sources having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl. The term “freshwater” also refers to freshwater to which at least one PVCR modulator has been added, as described herein.

(Patent ‘883, col. 6, ll. 24 – 31; Patent ‘747, col. 9, ll. 27 – 35.) Similarly, the specifications of Patents ‘379 and ‘792 define “freshwater” as:

Water that comes from, for example, a stream, river, ponds, public water supply, or from other non-marine sources having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl. The term “freshwater” also refers to freshwater to which magnesium and calcium have been added, as described herein.

(Patent ‘379, col. 5, ll. 52 – 58; Patent ‘792, col. 6, ll. 32 – 39.)

The term freshwater is used in the patents in many instances to identify the water in which the pre-adult fish are initially held, which water will have low salinity, e.g., salinity levels of less than about 2 mM each of magnesium, calcium, and sodium chloride, as stated in the specifications. The term freshwater is also used in the patents to identify water to which a patented method is applied, in which water the fish are to be maintained for a period of time before transfer to

seawater.¹² In this context, freshwater describes “an aquatic mixture for providing an environment to improve the raising of pre-adult anadromous fish.” (Patent ‘883, col. 2, ll. 51 – 53.) For example, certain methods described in Patents ‘379 and ‘792 call for increasing the level of calcium to between 2.0 mM and 10.0 mM, and increasing the level of magnesium to between 0.5 mM and 10.0 mM.¹³ (E.g., Patent ‘379, claims 15 and 16; Patent ‘792, claims 16 and 17.) The term freshwater is also used in some instances to describe methods involving the introduction of a “PVCr modulator” to the water, which modulator may or may not be calcium or magnesium. (E.g., Patent ‘883, claim 14; Patent ‘747, claim 23.)¹⁴

After review of the record, as to Patents ‘379 and ‘792, the term “freshwater” reasonably means:

- (1) water from a freshwater source, such as water sourced from a stream, river, pond, or another non-marine source, having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl; and
- (2) water described in (1) to which has been added calcium and/or magnesium to achieve concentrations in the range of between 2 mM and 10 mM calcium and between 0.5 mM and 10 mM magnesium.

¹² One embodiment involves “intermittent ... exposure to freshwater having the PVCr modulator.” (E.g., Patent ‘379, col. 6, ll. 60 – 63.)

¹³ Whether the freshwater sources must have a starting concentration of less than 2 mM each of magnesium, calcium, and sodium chloride is not clear. The cited specification language uses “for example” when describing the “less than about 2 mM” levels. Presumably, the concentrations of calcium and magnesium in the source freshwater will be low. Defendants’ expert, Dr. Terrence Bradley, Ph.D., asserts that the U.S. Geological Survey defines “freshwater” as “water containing less than 1,000 milligrams per liter of dissolved solids, most often salt.” (Bradley Declaration ¶ 141, ECF No. 76-6, PageID # 3584.) According to Dr. Bradley, 2 mM converts to approximately 120 mg/L. (*Id.*) Dr. Bradley does not state, however, that freshwater typically contains 2 mM each of calcium, magnesium, and sodium salts, or that freshwater sources having 2 mM or higher concentrations of these salts would be used by aquaculture operations as a starting freshwater environment for pre-adult anadromous fish. In other words, assuming, arguendo, that some freshwater sources could contain 2 mM or greater concentrations of one or more of the salts and still meet the USGS definition of freshwater, the record does not include evidence that such water would be used in the aquaculture industry for source freshwater. As a comparator, the specification of Patent ‘883 states that natural seawater has greater than 30 mM magnesium, 6 mM calcium, and 300 mM NaCl. (Patent ‘883, col. 9, ll. 42 – 48.)

¹⁴ As is explained herein, calcium and magnesium are PVCr modulators. The claims of the ‘883 and ‘747 patents refer to freshwater to which a PVCr modulator had been added; whereas the claims of the ‘379 and ‘792 patents refer specifically to calcium and magnesium additions.

As to Patents ‘883 and ‘747, the term “freshwater” reasonably means:

- (1) water from a freshwater source, such as water sourced from a stream, river, pond, or another non-marine source, having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl; and
- (2) water described in (1) to which has been added a PVCR modulator or more than one PVCR modulator.

The definitions constitute plain and ordinary constructions that would be understood by the person of ordinary skill in the art following a review of the specifications.¹⁵

2. Maintained in [the] freshwater¹⁶

The parties propose the following construction of “maintained in [the] freshwater”:

Plaintiffs’ construction	Defendants’ construction
Refers to fish that are kept in freshwater for a period of time (ECF No. 64, PageID # 776.)	Indefinite (ECF No. 63, PageID # 663.)

According to Defendants, “maintained in the freshwater” is indefinite because a person of ordinary skill in the art would not understand the scope of the claimed invention due to the lack of any definite minimum or maximum period during which fish must be maintained in the freshwater. (Defendants’ Opening Brief at 19, PageID # 4751.) Plaintiffs contend that a person of ordinary skill in the art would plainly understand that fish would be maintained in the freshwater for “a

¹⁵ When the parties filed their claim construction briefs, Defendants argued that the patents included a sequential limitation on the patented methods for preparing the freshwater environment, such that a PVCR modulator added to the water would have to be introduced before the introduction of fish feed. (See Bradley Declaration ¶ 145.) During the *Markman* hearing, Defendants appeared to abandon this position. In any event, if this remains an area of dispute, the proposed finding is that the patents describe methods in which both components (freshwater additions and feed) are employed at the same time. There is no requirement of a particular sequence or order in which the components are introduced, provided that the fish and the additions are present together in the water. This construction is a plain and ordinary construction that would be evident to a person of ordinary skill in the art following a review of the patents. (See also Jury Declaration ¶ 94.)

¹⁶ Plaintiffs’ Opening Brief at 22; Declaration of Steven Jury ¶¶ 60 – 65; Defendants’ Opening Brief at 19; Declaration of Terrence Bradley ¶¶ 100 – 107; Plaintiffs’ Responsive Brief at 10; Defendants’ Rebuttal Brief at 22.

period of time” that would be sufficient to result in the benefits described in the patents, or for a longer period of time if desired. (Plaintiffs’ Opening Brief at 23, PageID # 941.)

The specifications explain the reason the patents do not include in their claims the precise period of time during which fish are to be maintained in the freshwater:

The process of the present invention pre-conditions the fish and prepares them for transfer. The pre-adult anadromous fish are maintained in a freshwater environment having a PVCR modulator long enough to increase the expression and/or alter sensitivity of the PVCR. The length of time depends on the physiological and physical maturity of the fish. Some fish will more readily adapt to the environment, and increase their expression and/or alter the sensitivity of their PVCR, while others will need more time to do so. Factors that can influence the length of time necessary to increase the expression and/or alter sensitivity of the PVCR include, but are not limited to, size of the fish, level of PVCR expression or sensitivity, if any, prior to addition of the PVCR modulator to the freshwater, the fish’s ability to excrete the PVCR modulator and ions, the fish’s surface to volume ratio, etc. Therefore, the length of time the fish is maintained can range from about 7 days to several months (e.g., 7, 14, 21, 30, 45, 90 and 120 days). The fish can also be maintained indefinitely so long as the fish are maintained in freshwater having the PVCR modulator and being fed a NaCl diet. For example, salmon, trout or char weighing less than 10 gms can be maintained in freshwater having a PVCR modulator, and fed a NaCl diet for at least about 180 days, prior to transfer to seawater.

(Patent ‘379, col. 7, ll. 1 – 24; Patent ‘792, col. 7, l. 63 – col. 8, l. 20; Patent ‘883, col. 8, ll. 18 – 41; Patent ‘747, col. 11, ll. 37 – 60.)

Based on the specifications, a person of ordinary skill in the art would understand that the methods described in the patents are to be applied during the pre-adult stage of fish development to induce or accelerate smoltification; that it would take, at a minimum, several days to prepare the fish for transfer to seawater; and that the fish are more likely to be prepared for transfer to seawater the longer the methods are applied during the pre-adult stage of development. A person of ordinary skill in the art would appreciate that a number of factors might influence an aquaculture

operation's timing of the transfer of fish to seawater, including species, starting size, and the growth cycle of the fish in question,¹⁷ and that the process can be maintained pending transfer to seawater.¹⁸

According to the specifications, “[f]ish hatcheries have experienced difficulty in raising [anadromous] fish because the window of time in which the pre-adult fish adapts to seawater (e.g., undergoes smoltification) is short-lived, and can be difficult to pinpoint.” (*E.g.*, Patent ‘883, col. 1, ll. 11 – 14.) If salinity levels do not increase after smoltification, the fish will die. (*Id.*, col. 11, ll. 25 – 29.) As taught, a primary advantage of the patented methods is that they “eliminate[] the phenomenon known as ‘smolt window,’” and permit the aquaculture operation to maintain fish in “freshwater” for a longer period to ensure that a greater percentage of fish are ready for transfer to seawater pens. (*Id.*, col. 17, ll. 40 – 41.)

The patents’ use of “maintained in the freshwater,” is not indefinite, but rather of necessity refers to the general period of time in which pre-adult fish are prepared for transfer to seawater. The duration described in the specifications – between several days and several months, and even for a prolonged (i.e., greater than 180-day) period – describes an understandable period. While the specifications inform that the methods are designed to transition a population of fish through the smoltification process relatively promptly and with minimal loss, recognizing that some fish

¹⁷ The patents all pertain to fish that are ready for smoltification, “the stage at which a fish undergoes the acclimation or adaptation from freshwater to seawater,” which stage “varies from species to species.” (*E.g.*, Patent ‘883, col. 6, ll. 12 – 20.) According to the patentees, the combined methods related in Patent ‘883 will induce or accelerate smoltification. (*E.g.*, *id.*, col. 10, ll. 46 – 54.) The patentees report that 5 days of the method described in Patent ‘883 resulted in a 99% survival rate for Atlantic salmon, compared to a 33% survival rate for fish that were not subjected to the method. (*Id.*, col. 11, ll. 14 – 18.) Additionally, Patent ‘883 teaches that the patented method will accelerate the growth of fish, so that, for example, fish will achieve sexual maturity within 6 to 12 months rather than 2 to 3 years. (*Id.*, col. 10, ll. 15 – 32.) In two preferred embodiments known as APS Process I and APS Process II, fish are maintained in a “regimen of water mixture and feed for a total of 30 – 45 days.” (*Id.*, col. 18, ll. 36 – 38, 51 – 53.)

¹⁸ In other words, “maintained” also denotes an ongoing process culminating in transfer to seawater. (*E.g.*, Patent ‘883, col. 1, ll. 50 – 52: “The pre-adult anadromous fish can be maintained in the freshwater having at least one PVCr agonist until they are ready to be transferred to seawater.”)

might respond more quickly to the methods than others, neither the specifications nor the claims describe a precise time period. The lack of a precise time period does not render the term indefinite. The specifications identify the factors that affect the length of time the fish must be maintained in the freshwater, and adequately inform the person of ordinary skill in the art that maintaining the processes for more than a few days will help prepare anadromous fish for a seawater transfer, and that maintaining the processes for weeks or months will increase the likelihood that preparedness for seawater transfer is shared throughout a fish population, without subjecting already prepared fish to the harms otherwise associated with a delayed transfer and the indeterminate smolt window. In addition, the specifications teach the use of samples and assays to determine an increase in expression of PVCR in the fish and an increase in PVCR modulator concentration in fish blood, discussed further below, which increases will inform the person of ordinary skill in the art that the fish are being prepared for transfer to seawater. (Patent ‘379, col. 10 – 15 & Examples 1, 3 – 5, 7; Patent ‘792, col. 11 – 16 & Examples 1, 3 – 5, 7; Patent ‘883, col. 12 – 14 & Examples 1, 3 – 5, 7; Patent ‘747, col. 18 – 23 & Examples 1, 3 – 7, 18 – 20.)

In short, a person of ordinary skill in the art would understand that whether a particular fish population is prepared for transfer to seawater could be assessed by means of such samples and assays. A person of ordinary skill in the art would also appreciate that the patentees could not reasonably be expected to provide a specific minimum duration for the process that would prepare equally all anadromous fish, or all salmon, for transfer to seawater. Accordingly, a reasonable construction of “maintained in [the] freshwater” is “kept in freshwater for a period of time.”

C. Polyvalent Cation Receptor (PVCR) Terminology

A stated objective of the patented processes is “to increase [or modulate] expression and/or sensitivity of at least one PVCR.” (*See, e.g.*, Patent ‘379, claim 13; Patent ‘747, claim 22; Patent

‘792, claim 14; Patent ‘883, claim 11.) This is accomplished, according to the patents, through the addition of a “PVCR modulator” or a “PVCR agonist” to the freshwater and/or the fish feed. (Patent ‘379, claims 13; Patent ‘792, claim 14; Patent ‘883, claims 11, 23; Patent ‘747, claims 22 – 24.) The patented methods teach that the fish incorporate the PVCR modulator, which increases the expression of PVCR found in certain tissue. (Patent ‘379, col. 10 – 15; Patent ‘792, col. 11 – 16; Patent ‘883, col. 12 – 14; Patent ‘747, col. 18 – 23.)

Patent ‘379:

13. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

- a) Adding magnesium and calcium to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and
- b)

Patent ‘792:

14. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

- a) adding magnesium and calcium to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and
- b)

Patent ‘883:

11. A method for preparing pre-adult anadromous fish for transfer from freshwater to seawater, comprising:

- a) adding at least one PVCR modulator to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and
- b)

Patent '747:

22. A method of preparing pre-adult salmon for transfer from freshwater to seawater, comprising:

a) adding at least one PVCR modulator to the freshwater in an amount sufficient to modulate expression and/or sensitivity of at least one PVCR; and

b)

23. The method of claim 22, wherein the pre-adult salmon are maintained in the freshwater having at least one PVCR modulator until the pre-adult salmon are transferred to seawater.

24. The method of claim 23, wherein the PVCR modulator is a PVCR agonist.

The parties request construction of the terms “Polyvalent Cation [Sensing] Receptor” or “PVCR,” “PVCR modulator,” “PVCR agonist,” “expression” and “sensitivity.”

I. Polyvalent Cation [Sensing] Receptor (PVCR)¹⁹

The parties propose the following construction of “Polyvalent Cation Sensing Receptor (PVCR):

Plaintiffs’ construction	Defendants’ construction
G protein-coupled receptor proteins that can detect cation levels in extracellular fluid surrounding cells (ECF No. 64, PageID # 781.)	polyvalent cation sensing receptor (PVCR) is also known as calcium/polyvalent cation-sensing receptor, Ca-sensing receptor, calcium receptor (CaR), aquatic polyvalent cation-sensing receptor, aquatic PVCR (ECF No. 63, PageID # 666.)

As explained in the patents’ backgrounds and figures, PVCR refers to the “Polyvalent Cation Sensing Receptor,” which receptor is present in the tissue of fish and other organisms.

¹⁹ Plaintiffs’ Opening Brief at 38; Defendants’ Opening Brief at 12; Declaration of Terrence Bradley ¶¶ 146 – 150; Plaintiffs’ Responsive Brief at 11; Defendants’ Rebuttal Brief at 29; Plaintiffs’ Reply at 15; Defendants’ Reply at 7.

(Patent ‘379, col. 25 – 26; Patent ‘792, col. 30 – 32; Patent ‘883, col. 6, ll. 35 – 52; Patent ‘747, col. 37 – 39; Bradley Declaration, ECF No. 76-6, PageID # 3557 – 58.)

Based on the specifications for Patents ‘379, ‘792, and ‘883²⁰, the prior art noted in the specifications,²¹ prior art and contemporary scholarship identified in Plaintiffs’ claim construction chart,²² and the supplied extrinsic evidence,²³ for purposes of the patents-in-suit, the PVCR term reasonably refers to a sensing receptor in various tissues of anadromous fish, which receptor (a) senses the presence of polyvalent cations both in surrounding water and internally to the fish,²⁴ and (b) was varyingly described within the relevant art, prior to the patent filing dates, as a G

²⁰ As exemplified in Patent ‘883:

A PVCR has been isolated from various tissues of several types of anadromous fish using molecular biology techniques, as described in Example 9. ...

The PVCR, which is located in various tissues (e.g., gill, skin, intestine, kidney, urinary bladder, brain or muscle) of the pre-adult anadromous fish, senses alterations in PVCR modulators including various ions (e.g., divalent cations), for example, in the surrounding water, in their serum or in the luminal contents of tubules inside the body, such as kidney, urinary bladder, or intestine. Its ability to sense these modulators increases expression of the PVCR, thereby allowing the fish to better adapt to seawater. Increase expression of the PVCR can occur, for example, in one or all tissues.

(Patent ‘883, col. 6, ll. 35 – 37, 46 – 56.)

²¹ *E.g.*, Patent ‘883, col. 44, ll. 38 – 59.

²² Nearing et al., “Polyvalent cation receptor proteins (CaRs) are salinity sensors in fish.” 99 Proc. Nat. Acad. Sci. (No. 14) 9213-9236 (July 9, 2002) (ECF No. 73-8); Bai et al., “Expression and Characterization of Inactivating and Activating Mutations in the Human Ca²⁺ sensing Receptor.” 271 J. Bio. Chem. (No. 32) 19537-19545 (Aug. 9, 1996) (ECF No. 72-7); Conigrave et al., “L-Amino acid sensing by the extracellular Ca²⁺-sensing receptor.” 97 Proc. Nat. Acad. Sci. (No. 9) 4814-4819 (April 25, 2000) (ECF No. 72-8).

²³ *E.g.*, Bradley Declaration ¶¶ 147 – 150 (ECF No. 76-6).

²⁴ As described in the specifications, the receptor senses the presence of, “e.g., divalent cations ... in the surrounding water, in [the fish’s] serum or in the luminal contents of tubules inside the body, such as kidney, urinary bladder, or intestine.” (*E.g.*, Patent ‘883, col. 6, ll. 46 – 52.) One example of a polyvalent cation is calcium (Ca²⁺).

protein-coupled receptor protein, calcium/polyvalent cation-sensing receptor, Ca-sensing receptor, calcium receptor (CaR), aquatic polyvalent cation-sensing receptor, or aquatic PVCR.²⁵

2. *PVCR modulator*²⁶

The parties propose the following construction of “PVCR Modulator”:

Plaintiffs’ construction	Defendants’ construction
<p>A compound which modulates (e.g., increases and/or decreases) expression of a PVCR, and/or alters the sensitivity or responsiveness of the PVCR</p> <p>(ECF No. 64, PageID # 804.)</p>	<p>For patents ‘792 and ‘883:</p> <p>A compound which increases expression of the PVCR, or increases the sensitivity or responsiveness of the PVCR.</p> <p>For patents ‘747:</p> <p>A compound which modulates (e.g., increases and/or decreases) expression of the PVCR, or alters the sensitivity or responsiveness of the PVCR.</p> <p>(ECF No. 63, PageID # 669.)</p>

For all four patents, Plaintiffs propose a uniform construction that recognizes that the term “modulate” can mean either increase or decrease. (Plaintiffs’ Opening Brief at 39, PageID # 957.)

Defendants argue that Plaintiffs’ proposed construction should only apply to Patent ‘747, and that

²⁵ The most simplistic description of PVCRs in the record is that they “serve as salinity sensors in fish.” (Patent ‘747, col. 23 – 24.) However, Defendants suggest that this construction should not be adopted, at least for the three earlier-filed patents, which do not include this description. (Defendants’ Opening Brief at 13, PageID # 4745.) “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application.” *Phillips*, 415 F.3d at 1313. According to Nearing et al., *supra* note 22, at 9231, published in 2002 (and therefore not prior art), the authors “provide[d] evidence that CaRs allow fish to sense and respond to alterations in water salinity based on changes in Ca²⁺, Mg²⁺, and Na⁺ concentrations found in freshwater, brackish water, and seawater.” In any event, although the “salinity sensor” construction is likely implicit from the specifications of all four patents, the proposed construction avoids this construction because it would not be necessary to distill the PVCR term to “salinity sensor” for it to have meaning to a person of ordinary skill in the art. Additionally, the specifications and prior art suggest that there are non-saline polyvalent cations such as amino acids. Conigrave et al., *supra* note 20, at 4814.

²⁶ Plaintiffs’ Opening Brief at 38 – 40; Defendants’ Opening Brief at 12 – 14; Plaintiffs’ Responsive Brief at 12 – 13; Defendants’ Rebuttal Brief at 29; Plaintiffs’ Reply at 15; Defendants’ Reply at 8.

Plaintiffs' use of "PVCR modulator" in the earlier patents restricts the meaning of PVCR modulator to a substance that increases expression or sensitivity. (Defendants' Opening Brief at 13 – 14, PageID # 4745 – 46.) Plaintiffs contend that the four patents suggest that modulate can mean decrease as well as increase because the specifications use the word "alter" to describe modulation. (Plaintiffs' Responsive Brief at 13, PageID # 4826.)

Except for Patent '747, the specifications for the patents-in-suit define PVCR modulators and teach methods of using PVCR modulators exclusively to increase PVCR expression:

A "PVCR modulator" is defined herein to mean a compound which increases expression of the PVCR, or increases the sensitivity or responsiveness of the PVCR. Such compounds include, but are not limited to, PVCR agonists ... and compounds that indirectly alter PVCR expression

(Patent '883, col. 6, ll. 57 – 63; *see also* Patent '379, col. 6, ll. 16 – 20; Patent '792, col. 6, l. 64 – col. 7, l. 1.) As used in the specifications of Patents '379, '792, and '883, therefore, "PVCR modulator" is defined ... to mean a compound which increases expression of the PVCR, or increases the sensitivity or responsiveness of the PVCR." (Patent '379, col 6, ll. 16 – 18; Patent '792, col. 6, ll. 64 – 66; Patent '883, col. 6, ll. 57 – 59.) Given that Plaintiffs' own lexicon defines the modulator as "increasing" the responsiveness or sensitivity, and given that the specification language is consistent with the use of the "PVCR modulator" term in the representative claims within Patents '792 and '883,²⁷ all of which claims describe the use of a PVCR modulator to increase expression and/or sensitivity, construction of "PVCR modulator" as a compound that will

²⁷ Patent '379 does not reference "PVCR modulator" in its claims. However, the specification of Patent '379 defines "PVCR modulator" the same way as the specifications of Patents '792 and '883. For purposes of Patents '792 and '883, because the specifications' lexicography and the claim terms are consistent in their reference to increased expression of PVCR, the proposed construction does not import a limitation from the specifications into the claims. Similarly, no limitation is imposed on the claims in Patent '379 because the additions of calcium and magnesium described in those claims are stated to cause an increase in PVCR expression.

increase expression of the PVCR or the sensitivity or responsiveness of the PVCR is a reasonable construction.²⁸

As used in the specification of Patent ‘747, however, a “‘PVCR modulator’ is ... a compound which modulates (e.g., increases and/or decreases) expression of the PVCR, or alters the sensitivity or responsiveness of the PVCR.” (Patent ‘747, col. 9, ll. 62 – 65.) Additionally, the claims of Patent ‘747 refer to additions that are sufficient to “modulate expression and/or sensitivity” rather than “increase expression and/or sensitivity.” (*Id.*, claims 22, 35, 37.) Accordingly, for Patent ‘747, the term “PVCR modulator” refers to a compound that increases and/or decreases expression of the PVCR or the sensitivity or responsiveness of the PVCR.

3. *PVCR agonist*²⁹

The parties propose the following construction of “PVCR agonist”:

Plaintiffs’ construction	Defendants’ construction
A compound which increases the expression of a PVCR and/or increases the sensitivity or responsiveness of a PVCR (ECF No. 64, PageID # 799.)	“agonist” a chemical that binds to a receptor and activates the receptor to produce a biological response (ECF No. 63, PageID # 668.)

Patents ‘883 and ‘747 reference “PVCR agonists.” The specifications reflect that a PVCR agonist is a type of PVCR modulator that “indirectly alter[s] PVCR expression.” (Patent ‘883, col. 6, ll. 57 – 60; Patent ‘747, col. 9, l. 62 – col. 10, l. 2.) The specifications also state that examples of PVCR agonists include calcium, magnesium, and amino acids in certain

²⁸ This proposed construction applies exclusively to PVCR modulator additions to the freshwater. It does not extend to NaCl additions to feed. As taught in Patent ‘883, “NaCl is a direct negative PVCR modulator, and works to decrease[] PVCR sensitivity” but “surprisingly increases PVCR expression when ... the surrounding freshwater environment has at least one PVCR modulator in it” due to “increase[d] ingestion of the freshwater having PVCR modulators.” (Patent ‘883, col. 8, ll. 52 – 59.)

²⁹ Plaintiffs’ Opening Brief at 38 – 40; Defendants’ Opening Brief at 12 – 14; Plaintiffs’ Responsive Brief at 12; Defendants’ Rebuttal Brief at 29; Defendants’ Reply at 8.

concentrations. (Patent ‘883, col. 6, l. 66 – col. 7, l. 25; Patent ‘747, col. 10, ll. 12 – 34.) For example, according to the specifications, the presence of a PVCR agonist such as calcium (Ca²⁺) enables PVCR in organs or tissues to “better sense amino acids.” (Patent ‘747, col. 10, ll. 39 – 41.) Defendants cite in support of their proposed construction a Wikipedia entry they visited in 2015. (PageID # 668.)

Based on the specifications, which are consistent with the prior art cited by Plaintiffs, a “PVCR agonist” is a PVCR modulator that indirectly alters PVCR expression or sensitivity, by stimulating PVCR responsiveness to PVCR modulators (polyvalent cations). In addition, because a PVCR agonist is a PVCR modulator, as used by the patentees, PVCR agonist is subject to the proposed construction of PVCR modulator set forth above regarding “increase and/or decrease.” In other words, for purposes of Patent ‘883, PVCR agonists increase expression or sensitivity, whereas for Patent ‘747, PVCR agonists may also stimulate a decrease in expression or sensitivity.

4. Expression and/or sensitivity of a PVCR³⁰

All of the patents teach methods that involve the addition of one or more PVCR modulators, such as calcium, in an amount sufficient to modulate “expression and/or sensitivity of at least one PVCR.” The parties request that the Court construe the terms “expression” and “sensitivity” as follows:

Plaintiffs’ construction	Defendants’ construction
“Sensitivity” means the responsiveness of a PVCR. (ECF No. 64, PageID # 816.) “Expression” means gene expression. (<i>Id.</i> , PageID # 750.)	“Sensitivity” is indefinite. (ECF No. 63, PageID # 669.) “Expression and/or sensitivity” is indefinite. (<i>Id.</i> , PageID # 627, 636, 656)

³⁰ Plaintiffs’ Opening Brief at 27 – 34; Defendants’ Opening Brief at 41 – 42; Plaintiffs’ Responsive Brief at 28 – 29; Defendants’ Rebuttal Brief at 24 – 26; Plaintiffs’ Reply at 13.

The patent specifications repeatedly provide that sensitivity is synonymous with responsiveness, and that the patented methods will enhance the sensitivity/responsiveness of PVCR in pre-adult fish, i.e., enhance the sensitivity or responsiveness of the receptor to the presence of polyvalent cations. (Patent ‘379, col. 6, ll. 16 – 24; Patent ‘792, col. 6, ll. 64 – 66; Patent ‘883, col. 6, ll. 57 – 59; Patent ‘747, col. 9, ll. 62 – 65, col. 10, ll. 39 – 41.) These intrinsic references clearly suggest to the person of ordinary skill in the art that sensitivity is synonymous with responsiveness. In any event, both words have a plain meaning and, accordingly, “sensitivity” is not indefinite and means sensitivity or responsiveness.³¹

The patents also repeatedly refer to PVCR “expression.” (*See, e.g.*, Patent ‘883, col. 6, ll. 52 – 54, indicating that the PVCR “ability to sense these modulators increases expression of the PVCR, thereby allowing the fish to better adapt to seawater.”) The specifications, prior art, and extrinsic evidence all support the conclusion that “gene expression” is the appropriate construction for the term “expression.” For instance, the specifications identify Northern blot analysis of “mRNA from tissue samples” and hybridization applied to “DNA containing tissue sample[s].” (Patent ‘379, col. 12, ll. 36 – 46; Patent ‘792, col. 13, ll. 55 – 65; Patent ‘883, col. 14, ll. 8 – 17; Patent ‘747, col. 20, ll. 48 – 58.)³²

³¹ Defendants’ expert, Dr. Bradley, observes that sensitivity refers to “capacity of a protein or receptor to detect/bind a specific ligand” and “typically requires an alteration in the affinity of the protein/receptor or an increase in the number of active receptors.” (Bradley Declaration ¶ 53, ECF No. 76-6, PageID # 3566.) Although extrinsic evidence is not necessary to and was not used to construe the term, Dr. Bradley’s declaration is noted because his observations are consistent with the proposed construction. The proposed construction is also consistent with the prior art disclosure identified by Plaintiff. (Plaintiffs’ Opening Brief at 28 – 29, PageID # 946 – 47 (citing Conigrave, A., 97 Proc. Nat. Acad. Sci. 4814 (ECF No. 72-8).))

³² *See also* Patents ‘379, ‘792, ‘883, ‘747, Examples 1, 3 & 4; Patent ‘747, Example 20; Jury Declaration ¶¶ 55 – 59, ECF No. 72, PageID # 982 (describing both “protein expression and mRNA expression”); Bradley Declaration ¶ 65, ECF No. 76-6, PageID # 3569 (asserting that “[e]xpression of, or changes, in the quantity of specific mRNAs do not always result in synthesis of the specific protein”); Defendants’ Claim Construction Chart, ECF No. 63, PageID # 633 (Gamba reference) & PageID # 661 (citing <http://ghr.nlm.nih.gov/glossary=geneexpression>); Bradley Deposition at

D. NaCl

In their rebuttal brief and at the *Markman* hearing, Defendants requested a construction for the term NaCl that is different for Patent ‘747 than the construction of the term when used in the earlier three patents.³³ (Defendants’ Rebuttal Brief at 28 n.28.) Defendants’ argument is based on a clear distinction in specification language for Patent ‘747.

Patents ‘379, ‘792, ‘883

“[A]s used herein, the term NaCl, includes a substantially pure compound, and mixtures of NaCl with other sources of sodium.”

(*E.g.*, Patent ‘379, col. 7, ll. 51 – 53.)

Patent ‘747

“[A]s used herein, the term NaCl, includes a substantially pure compound, mixtures of NaCl with other sources of sodium *and mixtures of other sources of sodium.*”

(Patent ‘747, col. 12, ll. 27 – 30 (emphasis added).)

Because Plaintiffs have advocated a construction for all four patents-in-suit based on the specification of Patent ‘747, and because the earlier-filed patents-in-suit plainly provide a different

134 – 35, 139 – 40, ECF No. 73-10, PageID # 1500 (describing Western blot assays to determine change in expression of calcium receptors).

³³ In the Joint Claim Construction Chart, neither party proposed a construction for NaCl that would be different for Patent ‘747.

Plaintiffs’ construction	Defendants’ construction
<p>“NaCl” with respect to the patents-in-suit shall mean sodium chloride (e.g., substantially pure sodium chloride), mixtures of sodium chloride with other sources of sodium, and mixtures of other sources of sodium</p> <p>(ECF No. 64, PageID # 711.)</p>	<p>“NaCl” means substantially pure compound and mixtures of NaCl with other sodium salts.</p> <p>(ECF No. 63, PageID ## 605, 617, 628, 693)</p>

In a footnote in their rebuttal brief, Defendants suggested Patent ‘747 had a broader definition. At that time, Defendants argued that the patents require NaCl additions, such that a POSA would interpret the claims to require formulation or reformulation of feed. (see § E.4 below).

definition of NaCl, Defendants' argument against a uniform construction is persuasive. Indeed, in each patent, Plaintiffs have provided a specific definition for NaCl that differs from its ordinary meaning. Under the circumstances, therefore, "the inventor's lexicography governs." *Phillips*, 415 F.3d at 1316.

Accordingly, the appropriate construction of NaCl for Patents '379, '792, and '883, is "a substantially pure compound, and mixtures of NaCl with other sources of sodium;" for Patent '747, the apt construction is "a substantially pure compound, mixtures of NaCl with other sources of sodium and mixtures of other sources of sodium."

E. Terms of Measurement or Degree

The representative claims include several references to terms of measurement or degree, which terms pertain both to the additions made to the freshwater and to the alleged impact of the additions on anadromous fish. Defendants contend the terms are indefinite. A review of the specifications reveals reasonable constructions of the terms.

Importantly, following the Supreme Court's opinion in *Nautilus*, the Federal Circuit held that terms of degree are not "inherently indefinite." *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1370 (Fed. Cir. 2014) *cert. denied*, 136 S. Ct. 59 (2015).

We do not understand the Supreme Court to have implied in *Nautilus*, and we do not hold today, that terms of degree are inherently indefinite. Claim language employing terms of degree has long been found definite where it provided enough certainty to one of skill in the art when read in the context of the invention.

Id. (citing, *inter alia*, *Enzo Biochem, Inc. v. Applera Corp.*, 599 F.3d 1325, 1335 (Fed. Cir. 2010) (holding that the claim phrase "not interfering substantially" was not indefinite even though the construction "define[d] the term without reference to a precise numerical measurement"))).

1. Additions³⁴ of “magnesium and calcium ... in an amount”³⁵

According to Defendants, the patents are indefinite regarding the appropriate amount of additions because “a POSA [person of ordinary skill in the art] would not know what is (and is not) a sufficient amount of modulation of expression or sensitivity to fall within the claims.” (Defendants’ Opening Brief at 37, PageID # 4769.) Plaintiffs argue that Defendants confuse the issue, and that “sufficient” relates to the amount of additions, not the degree of modulation. (Plaintiffs’ Responsive Brief at 24, PageID # 4837.)

Patent ‘379:

13. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

a) Adding magnesium and calcium to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and

Patent ‘792:

14. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

a) adding magnesium and calcium to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and

The parties propose the following construction of “magnesium and calcium ... in an amount”:

³⁴ The parties offer alternative proposed constructions for the term “adding” that do not suggest any real dispute. (Compare ECF No. 63, PageID # 605 (“to join or unite”) with ECF No. 64, PageID # 714 (plain meaning).) “Adding” has a plain and ordinary meaning that does not require construction.

³⁵ Plaintiffs’ Opening Brief at 13 – 20; Defendants’ Opening Brief at 10, 36 – 38; Plaintiffs’ Responsive Brief at 24 – 27; Defendants’ Rebuttal Brief at 13 – 19; Plaintiffs’ Reply at 9 – 11; Defendants’ Reply at 12 – 14.

Plaintiffs' construction	Defendants' construction
<p>Levels of magnesium and calcium are taught in the specifications: between about 2.0 mM and about 10.0 mM calcium; between about 0.5 mM and about 10.0 mM magnesium.</p> <p>(ECF No. 64, PageID # 736.)</p>	<p>Indefinite</p> <p>(ECF No. 63, PageID ## 606, 627 – 628.)</p>

The specifications teach that additions of magnesium and calcium to achieve certain molar concentrations will result in PVCRC modulation. Specifically, the amounts of calcium and magnesium are described as follows:

The amount of calcium added to the freshwater is an amount sufficient to bring the concentration up to between about 2.0 mM and about 10.0 mM, and the amount of magnesium added is an amount sufficient to bring the concentration up to between about 0.5 mM and about 10.0 mM.

(Patent '379, col. 1, ll. 58 – 63.)

Examples of polycations are divalent cations including calcium at a concentration between about 2.0 and about 10.0 mM and magnesium at a concentration between about 0.5 and about 10.0 mM.

(*Id.*, col. 6, ll. 20 – 24.)

The same descriptive language is provided in the other patents. (Patent '792, col 2, ll. 58 – 63, col. 7, ll. 1 – 5; Patent '883, col. 1, ll. 59 – 64, col. 2, ll. 54 – 59; Patent '747, col. 2, ll. 23 – 28, col. 3, ll. 54 – 59.) Furthermore, one preferred embodiment is to bring the concentration of both calcium and magnesium to the recommended levels (2.0 – 10.0 mM calcium and 0.05 – 10 mM magnesium). (*E.g.*, Patent '379, col. 6, ll. 41 – 47; Patent '883, col. 7, ll. 58 – 64.) Sources

of calcium and magnesium are also identified, and include seawater,³⁶ Ca(CO₃)₂, CaCl₂, CaSO₄, MgCl₂, MgSO₄, MgBr₂, and MgCO₃. (E.g., Patent ‘379, col. 6, ll. 47 –59; Patent ‘883, col. 7, l. 64 – col. 8, l. 9.) When viewed in light of the specifications, the amount of the additions is reasonably definite. In particular, the amount of calcium and magnesium additions means molar concentrations of between about 2.0 and about 10.0 mM calcium and about 0.05 and about 10.0 mM magnesium.

2. Additions of “at least one PVCR modulator ... in an amount”³⁷

Representative claims in Patents ‘747 and ‘883 describe methods that include the addition of “at least one PVCR modulator.”

Patent ‘747:

22. A method of preparing pre-adult salmon for transfer from freshwater to seawater, comprising:

³⁶ The parties disagree whether the specifications teach that a person of ordinary skill in the art might use, exclusively, diluted seawater (brackish water), to practice the methods taught in the patents. This issue is generated by the following specification language:

In one preferred embodiment, the present invention is practiced by adding a combination of two PVCR agonists to the freshwater. In particular, calcium and magnesium are added to the freshwater to bring the concentrations of each to between about 2.0 mM and about 10.0 mM of calcium, and between about 0.5 mM and about 10.0 mM of magnesium. In addition to adding calcium and magnesium to the water, these ranges of ion concentrations can be achieved by providing a brackish water (e.g., diluted seawater) environment for the fish.

(E.g., Patent ‘379, col. 6, ll. 41 – 50; Patent ‘883, col. 7, ll. 58 – 67.) According to Plaintiffs, “In addition to” does not mean that seawater can be relied on as the only source for additions of calcium and magnesium, but rather that seawater additions can be used to supplement additions of calcium and magnesium. (Plaintiffs’ Opening Brief at 25 – 26, PageID # 943 – 44; Jury Declaration ¶ 86, PageID # 992 – 93.) Defendants assert that the patents teach that seawater alone can be used to achieve the recommended concentrations. (Defendants’ Opening Brief at 17 – 18, PageID # 4749; Bradley Declaration ¶¶ 127 – 128, PageID # 3581 – 82.)

The addition of seawater would create an aquatic mixture with higher concentrations of both calcium and magnesium than source freshwater. Therefore, assuming that seawater additions alone would enable an aquatic mixture in which the concentrations of both calcium and magnesium are within the identified ranges, the specifications do not exclude the use of seawater (or artificial seawater such as “Instant Ocean,” see Bradley Declaration ¶ 128) as a means of practicing the patented methods. However, this dispute is ancillary to claim construction because the claims teach additions of magnesium and/or calcium, or additions of PVCR modulator(s).

³⁷ Plaintiffs’ Opening Brief at 13 – 20; Defendants’ Opening Brief at 10, 36 – 38; Plaintiffs’ Responsive Brief at 24 – 27; Defendants’ Rebuttal Brief at 13 – 19; Plaintiffs’ Reply at 7 – 11; Defendants’ Reply at 12 – 14.

a) adding at least one PVCR modulator to the freshwater in an amount sufficient to modulate expression and/or sensitivity of at least one PVCR; and ...

Patent '883:

11. A method for preparing pre-adult anadromous fish for transfer from freshwater to seawater, comprising:

a) adding at least one PVCR modulator to the freshwater in an amount sufficient to increase expression and/or sensitivity of at least one PVCR; and

The parties propose the following construction of “at least one PVCR modulator ... in an amount”:

Plaintiffs’ construction	Defendants’ construction
Levels of representative PVCRs are taught in the specifications. (ECF No. 64, PageID # 715.)	Indefinite (ECF No. 63, PageID ## 606, 627, 698.)

Plaintiffs propose a more definite construction that introduces the following example: “such as a quantity of calcium ... and/or a quantity of magnesium” at the molar concentrations discussed in the preceding section. (ECF No. 64, PageID # 715.) In fact, this is the preferred embodiment taught in the ‘747 and ‘883 patents. (Patent ‘883, col. 7, ll. 58 – 67; Patent ‘747, col. 11, ll. 8 – 17.) The specifications also provide that other polycations and amino acids added to water in certain concentrations will act as PVCR modulators (Patent ‘883, col 6, l. 57 – col. 7, l. 34; Patent ‘747, col. 9, l. 62 – col. 10, l. 50), which reinforces Plaintiff’s proposed “such as” construction. Contrary to Defendants’ contention, the reference to additions of “PVCR modulators” in the representative claims of Patents ‘747 and ‘883 is not indefinite and includes, for example, additions of calcium and/or magnesium at the molar concentration described in the

specifications, or of other polycations or amino acids in the concentrations noted in the specifications.

3. “Sufficient to increase [or modulate] expression and/or sensitivity” of a PVCR³⁸

The representative claims in Patents ‘883, ‘792, and ‘379 teach that the methods include additions made to freshwater that are “sufficient to increase expression and/or sensitivity” of at least one PVCR, while Patent ‘747 teaches that the methods involve additions “sufficient to modulate expression and/or sensitivity.” Defendants contend that “without disclosure of how much modulation of expression or sensitivity is required, there is no way to determine how much PVCR modulator is required to attain the desired result.” (Defendants’ Opening Brief at 37 – 38, PageID # 4760 – 70.) Defendants also argue that the patents are not enabling because they do not teach “how to measure sensitivity,” and because “there is no way to measure sensitivity.” (*Id.* at 38.) Plaintiffs maintain the patents “clearly teach how one of ordinary skill in the art can determine whether the expression or sensitivity of a PVCR has been modulated ... by a PVCR modulator.” (Plaintiffs’ Responsive Brief at 25, PageID # 4838.)

The parties thus propose the following construction of “sufficient to increase [or modulate] expression and/or sensitivity” of a PVCR:

Plaintiffs’ construction	Defendants’ construction
Sufficient means enough (ECF No. 64, PageID # 740.)	Sufficient is indefinite (ECF No. 63, PageID ## 606, 627, 698.)

The parties’ dispute is related to some extent to their disagreement regarding the amounts of additions as measured by resulting molar concentrations. Defendants argue that a person of

³⁸ Plaintiffs’ Opening Brief at 13 – 17, 32 – 33; Defendants’ Opening Brief at 36 – 41; Plaintiffs’ Responsive Brief at 24 – 26; Defendants’ Rebuttal Brief at 13 – 19; Plaintiffs’ Reply at 7 – 11; Defendants’ Reply at 12 – 14.

ordinary skill in the art who reviewed the patents would be unable to discern the scope of the invention(s) because there remains a need to “quantify” any resulting increase in both expression and sensitivity. (Defendants’ Opening Brief at 38 – 40, PageID # 4770 – 72.) According to Defendants, without quantifiable measures of increase, the claims have no “objectively meaningful boundaries” and are therefore void for indefiniteness. (Defendants’ Opening Brief at 39 (paraphrasing *Interval Licensing LLC*, 766 F.3d at 1371).)

As explained above, the patents are not indefinite as to the amounts of the PVCR modulator additions, which amounts are reasonably described in the specifications. In addition, the phrase “sufficient to increase expression and/or sensitivity” provides even further definition. The specifications set forth methods of assessing PVCR levels in fish, such as immunological techniques involving anti-PVCR antibodies, assays of biological samples by detection of a complex formed through the introduction of an antibody to the PVCR, and assays involving Northern blot analysis of mRNA tissue samples, among other techniques. (*E.g.*, Patent ‘883, col. 12 – 16.) A person of ordinary skill in the art would understand that by comparing samples from treated fish to samples from a control group (or samples taken from the treated fish prior to treatment), one is able to determine the existence of an increase in PVCR expression. The reference to additions of PVCR modulators found in the representative claims, therefore, is not indefinite and includes, for example, additions of calcium and/or magnesium at the molar concentration described in the specifications, or additions of other polycations or amino acids in the concentrations reflected in the specifications.

Quantification of precise relationships and formulae is not required for a claim to be reasonably definite or to enable one of skill in the art to practice the invention without undue experimentation. *See, e.g., Alcon Research Ltd. v. Barr Labs., Inc.*, 745 F.3d 1180, 1190 (Fed.

Cir. 2014). “Nor is it ‘a requirement of patentability that an inventor correctly set forth, or even know, how or why the invention works.’” *Id.* (quoting *Newman v. Quigg*, 877 F.2d 1575, 1581 – 82 (Fed. Cir. 1989) (citing *Diamond Rubber Co. v. Consol. Rubber Tire Co.*, 220 U.S. 428, 435 – 36 (1911))). Defendants’ contention that the patents are indefinite due to the alleged failure to offer precise measurement targets for expression and/or sensitivity demands more than is required to obtain a patent.³⁹

4. Feed containing “an amount of NaCl sufficient ...” and “at least about 1% NaCl by weight”⁴⁰

As with the other additions described in the patents, Defendants assert that the patents’ references to NaCl additions to fish feed are indefinite.

³⁹ Concerning the methods available to measure an increase in expression of a PVCR, there is no suggestion in the record that one method would identify an increase while another would not. *See PPG Indus., Inc. v. Guardian Indus. Corp.*, 75 F.3d 1558, 1563 (Fed. Cir. 1996) (finding no indefiniteness despite failure to specify which method should be used to measure ultraviolet transmittance because all conventional methods produced “essentially identical results”). This observation is also relevant to methods used by a person of ordinary skill in the art to measure PVCR concentrations in fish blood.

⁴⁰ Plaintiffs’ Opening Brief at 9 – 13; Defendants’ Opening Brief at 20 – 36; Plaintiffs’ Responsive Brief at 21 – 24; Defendants’ Rebuttal Brief at 13 – 16, 26 – 29; Plaintiffs’ Reply at 14; Defendants’ Reply at 9 – 12. *See also* Defendants’ Motion to Strike Plaintiffs’ New Proposed Claim Construction. (ECF No. 105.) In their motion to strike, Defendants challenge Plaintiffs’ suggestion in their Reply that there has never been a dispute regarding the meaning of “to contribute” in the phrase “an amount of NaCl sufficient to contribute to,” and question Plaintiffs’ argument that a plain and ordinary dictionary definition would suffice. (Plaintiffs’ Reply at 7 – 8.) Defendants’ motion to strike is not persuasive. In its Report of Conference of Counsel and Order dated June 11, 2015 (ECF No. 41), the Court imposed limitations on the parties’ ability to modify claim constructions, and in its Report of Conference and Order dated August 6, 2015 (ECF No. 48), the Court ordered Plaintiffs to “provide Defendants with Plaintiffs’ proposed definitions for the following terms: ‘sufficient to contribute to’” Plaintiffs responded that the term “sufficient” means “enough” and that the entire phrase means the amount of sodium chloride specified in the patents, *i.e.*, a concentration of “at least about 1% by weight.” (*See, e.g.*, Plaintiffs’ Opening Brief at 12.) Plaintiffs’ assertion in their reply brief on claim construction is not a modification of a prior position on a disputed claim term because the proposed construction still adheres to the specified amounts of sodium chloride. (Plaintiffs’ Reply at 8.) In other words, there is no surprise or prejudice resulting to Defendants from what is, in effect, Plaintiffs’ consistent specification-based / plain meaning argument in response to Defendants’ assertion that the larger phrase is indefinite as to the amount of NaCl in the feed. Indeed, the recommendation would not change in any event because nothing in the record, intrinsic or extrinsic, warrants the conclusion that construction of the term “contribute to” would be anything other than the plain and ordinary meaning of the term. Accordingly, the recommendation is that the Court deny Defendants’ motion to strike.

Patent '379

13. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

a) ...; and

b) adding feed for fish consumption to the freshwater, wherein the feed contains an amount of NaCl sufficient to contribute to a significantly increased level of calcium and/or magnesium in serum of the salmon fish.

19. A method for preparing pre-adult salmon for transfer from freshwater to seawater, comprising:

a) ...;

b) ...; and

c) adding feed for fish consumption to the freshwater, wherein the feed contains at least about 1% NaCl by weight.

Patent '747:

22. A method of preparing pre-adult salmon for transfer from freshwater to seawater, comprising:

a) ...

and

b) adding feed for fish consumption to the freshwater, wherein the feed contains an amount of NaCl sufficient to contribute to a significantly increased level of said PVCR modulator in serum of the pre-adult salmon fish.

Patent '792:

14. A method of improving the raising of pre-adult salmon, wherein the pre-adult salmon are maintained in freshwater prior to transfer to seawater, comprising:

a) ...; and

b) adding feed for fish consumption to the freshwater, wherein the feed contains an amount of NaCl and at least one PVCR modulator sufficient to contribute to a significantly increased level of calcium and/or magnesium in serum of the salmon fish.

Patent '883

23. A method for preparing pre-adult salmon for transfer from freshwater to seawater, comprising:

- a) ...; and
- b) adding feed for fish consumption to the freshwater, wherein the feed contains at least about 1% NaCl by weight.

24. The method of claim 23, wherein the feed contains between about 10,000 mg/kg and about 100,000 mg/kg of NaCl.

The parties propose the following construction of “an amount of NaCl sufficient”:

Plaintiffs’ construction	Defendants’ construction
<p>Sufficient means enough (ECF No. 64, PageID # 740.)</p> <p>Sufficient levels of NaCl are taught in the specifications. (<i>Id.</i>, PageID ## 740 – 741.)</p> <p>About 1% NaCl by weight</p> <p>The percentage by weight of sodium chloride is about 1%, but not necessarily exactly 1%.</p>	<p>Indefinite (ECF No. 63, PageID # 628.)</p> <p>“about 1%” about 1%, but not necessarily exactly 1%</p> <p>“by weight” Percentage by weight, independently present</p>

Defendants argue that the patents fail to inform the person of ordinary skill in the art as to “the amount of NaCl needed to elicit the claimed response.” (Defendants’ Opening Brief at 20, PageID # 4752.) Defendants also contend that the reference to 1% NaCl by weight is a minimum amount that must be added to the feed, which would mean that commercial feed containing 1% NaCl is not within the scope of the claims. (*Id.*) Plaintiffs maintain that Defendants’ proposed construction would improperly incorporate into the claims a limitation requiring that the person of ordinary skill make the fish feed. (Plaintiffs’ Responsive Brief at 21 – 22, PageID # 4834 – 35.)

The specifications provide that “at least about 1% NaCl by weight” and “an amount of NaCl sufficient to contribute” mean “feed having between about 1% and about 10% NaCl by weight.”⁴¹ (Patent ‘379, col. 2, ll. 13 – 16; Patent ‘792, col. 2, ll. 21 – 25; Patent ‘883, col. 2, ll. 19 – 22; Patent ‘747, col. 2, ll. 54 – 57.) Further, “the term NaCl includes a substantially pure compound, and mixtures of NaCl with other sources of sodium.” (E.g., Patent ‘379, col. 7, ll. 51 – 53.) For Patent ‘747 alone, the term also includes “mixtures of other sources of sodium.” (Patent ‘747, col. 12, ll. 29 – 30.) The specifications also teach that this amount of NaCl will enhance the level of calcium and magnesium present in blood serum, and will enhance PVCR expression by causing the fish to drink more of the surrounding water to which has been added calcium and/or magnesium or another PVCR modulator. (Patent ‘379, col. 7, ll. 40 – 42; Patent ‘792, col. 8, ll. 36 – 38; Patent ‘883, col. 8, ll. 57 – 59; Patent ‘747, col. 12, ll. 9 – 12.) In this manner, the specifications all provide reasonably definite explanations for the appropriate NaCl content of the fish feed, by weight.

Defendants nevertheless argue that it is improper to construe “an amount of NaCl sufficient to contribute” to mean “at least about 1% NaCl by weight” or “between about 10,000 mg/kg and about 100,000 mg/kg of NaCl” because certain claims would become redundant, such as claims 7 and 11 of Patent ‘883. (Defendants’ Rebuttal Brief at 15, PageID # 4889.) While there is a presumption that different claims have a different scope, the presumption is not irrebuttable and is sometimes referred to as a “rule of thumb.” *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1332 (Fed. Cir. 2009). *See also Netcraft Corp. v. eBay, Inc.*, 549 F.3d 1394, 1400 n. 1 (Fed.

⁴¹ Dependent claim 22, Patent ‘379 specifies that the feed should contain “between about 10,000 mg/kg and about 100,000 mg/kg of NaCl.” In the specifications, this measure is treated as an example of feed having between 1% and 10% NaCl by weight. (Patent ‘379, col. 1, ll. 52 – 57, col. 4, l. 65 – col. 5, l. 2.) The other patents also teach the mg/kg method of measuring NaCl content by weight. (E.g., Patent ‘883, col. 2, ll. 45 – 48; Patent ‘747, col. 3, ll. 45 – 48.)

Cir. 2008) (“While claim differentiation may be helpful in some cases, it is just one of many tools used by courts in the analysis of claim terms.”) As such, the presumption “does not trump the clear import of the specification.” *Edwards*, 582 F.3d at 1332. To the extent a claim describes feed that “contains an amount of NaCl sufficient to,” the specifications teach that it means “feed having between about 1% and about 10% NaCl by weight” (e.g., Patent ‘883, col. 2, ll. 19 – 22) or an “aquatic food composition having a concentration of NaCl between about 10,000 mg/kg and 100,000 mg/kg” (e.g., *id.*, col. 2, ll. 45 – 49). The specification does not limit the scope of the claim, but, rather, ensures that the general language used in the broadest formulation of the taught method has definite bounds. *Phillips*, 415 F.3d at 1315 (quoting *Autogiro Co. of Am. v. United States*, 384 F.2d 391, 398 (Ct. Cl. 1967)).

Defendants also argue that the claims require that one must add NaCl to fish feed in order to practice the patented methods. Relatedly, the patents describe preferred methods of the patented processes involving “APS Process I and APS Process II” (AquaBio Products Sciences®, LLC), which methods involve “feed pellets containing 7% (weight/weight) NaCl.” (E.g., Patent ‘747, col. 25 & 52 (Example 8); Patent ‘883, col. 18 & 42 (Example 8).) A review of Example 8 reveals that one preferred embodiment of the feed involves the manufacture or reformulation of fish feed to achieve NaCl content of 7% by weight. The example, however, does not establish the need to add NaCl to the feed. “Although the specification is important in discerning the meaning of the claims, federal trial judges must not ‘import’ or graft limitations from the specification into the claim.” *Advanced Aerospace Techs., Inc. v. United States*, 122 Fed. Cl. 445, 457 (2015). In other words, the fact that Example 8 describes a process of formulating fish feed does not justify the assumption that the claims are limited to methods that involve the manufacture or reformulation of fish feed. To the contrary, the plain language of the claims simply describes the use of feed

containing the identified NaCl content, by weight.⁴² Although adding NaCl to the feed might be an acceptable means of achieving the requisite NaCl level, neither the plain language of the claims, nor the specifications require the addition of NaCl to the feed.⁴³

5. “Significantly increased level”⁴⁴

As noted above, certain claims describe NaCl additions to fish feed in an amount that will “contribute to a significantly increased level” of PVCR modulator in the serum of fish. (*E.g.*, Patent ‘379, claim 13; Patent ‘792, claim 14.)

According to Defendants, the Patents’ use of the term “significantly increased” is indefinite because the claims do not quantify the amount of the increase of PVCR modulator in the serum that is necessary for the increase to be deemed significant. (Defendants’ Opening Brief at 21, PageID # 4753.) Defendants observe that the Patents use the word “significant” a number of times, in varying contexts, and that the term is not defined except in limited situations. (*Id.* at 23.) Plaintiffs argue that a person of ordinary skill in the art would understand that “significance” is a statistical term meaning $p < 0.05$. (Plaintiffs’ Opening Brief at 5 – 8, PageID # 923 – 26.)

⁴² Defendants further argue that the claims must be understood as limited to methods involving formulation or reformulation of feed because a POSA would not be able to measure the amount of NaCl present in commercial feed, particularly in relation to Patent ‘747, which includes within the definition of NaCl “mixtures of other sources of sodium.” (Defendants’ Rebuttal Brief at 28 & n.28.) While the argument may otherwise prove relevant to the defense, the specifications teach the use of feed having a specified NaCl content and, therefore, do not limit the scope of the invention to methods involving formulation or reformulation of feed.

⁴³ This discussion addresses the request for construction of both “Term 24” and “Term 18D” regarding the amount of NaCl in fish feed. Term 18D derives from Claim 14 of Patent ‘792, which describes additions of “an amount of NaCl and at least one PVCR modulator sufficient to contribute to a significantly increased level of calcium and/or magnesium in serum of the salmon fish.” (ECF No. 63 at 90; ECF No. 64 at 121.) As to Term 18D, the parties’ claim construction briefs focus on whether the amount of NaCl is definite enough to limit the scope of the invention. Regarding the NaCl content in feed, the proposed construction of Term 24 applies equally to Term 18D. Insofar as PVCR modulator content in feed is described in Term 18D, Patent ‘792 specifies “tryptophan in an amount between about 1 gm/kg and about 10 gm/kg,” or another amino acid in the same concentration. (Patent ‘792, col. 2, ll. 23 – 24, col. 7, ll. 25 – 30.)

⁴⁴ Plaintiffs’ Opening Brief at 4 – 8; Defendants’ Opening Brief at 21 – 29; Plaintiffs’ Responsive Brief at 13 – 21; Defendants’ Rebuttal Brief at 4 – 12; Plaintiffs’ Reply at 2 – 7; Defendants’ Reply at 9 – 11.

The parties propose the following construction of “significantly increased level”:

Plaintiffs’ construction	Defendants’ construction
<p>Refers to a statistically significant increase, indicated by a p-value that is less than 0.05, in the concentration of calcium and/or magnesium in the serum of pre-adult anadromous fish.</p> <p>For example, “a significantly increased level” of calcium and/or magnesium in serum of pre-adult anadromous fish occurs when the fish have been subjected to freshwater containing calcium in the range of about 2.0 mM to about 10.0 mM and/or magnesium in the range of about 0.5 mM to about 10.0 mM, and have been fed a feed containing at least about 1% by weight sodium chloride.</p> <p>(ECF No. 64, PageID # 818 – 19.)</p>	<p>Indefinite</p> <p>(ECF No. 63, PageID # 628.)</p>

With respect to claim terms of measurement or degree related to the NaCl content of fish feed, the term “significantly increased level” is a “term of approximation.” *Advance Aerospace*, 124 Fed. Cl. at 297 (construing the similar term “substantially” in a like manner) (citing *Apple Inc. v. Samsung Elecs. Co., Ltd.*, 786 F.3d 983, 1003 (Fed. Cir. 2015)). The term simply references the increase in the PVCR modulator level in serum that results from use of NaCl-enhanced feed in combination with the described PVCR modulator additions to the freshwater. An increased level of PVCR modulator in serum is a sign that the fish are being prepared for transfer to seawater.

Plaintiffs, however, argue for the inclusion of a statistical term. The patent specifications instruct that feed containing the stated amount of NaCl in combination with calcium and/or magnesium additions to the freshwater will result in increased levels of calcium and magnesium in the serum of treated fish, as compared with untreated fish. (Patent ‘379, col. 7, l. 65 – col. 8, l.

4; Patent ‘792, col. 9, ll. 3 – 9; Patent ‘883, col. 9, ll. 21 – 27; Patent ‘747, col. 12, ll. 53 – 59.) In Example 7, the patentees teach:

[S]erum calcium concentrations became elevated after an interval of 24 hr. Data points shown [in figure 21] represent a total of 5 or more independent determinations from a single representative experiment. Values at 24 hr and 72 hr are significantly ($p < 0.05$) increased as compared to the value at zero time.

(*E.g.*, Patent ‘379, col. 34, ll. 27 – 32; Patent ‘883, col. 39, ll. 23 – 28; *see also* Figure 21.)⁴⁵

According to the patentees’ findings, “measurements of serum calcium, magnesium and sodium ... demonstrate that the present invention causes a preconditioning of physiological and ionic transport mechanisms permitting the successful seawater transfer.” (*E.g.*, Patent ‘379, col. 33, ll. 39 – 46; Patent ‘883, col. 38, ll. 28 – 35.) The patentees posit that “the increase in serum calcium (a PVCR agonist) likely constitutes a signal for the initiation of multiple PVCR-activated processes in various organs to permit[] the survival of juvenile trout in seawater.” (*E.g.*, Patent ‘379, col. 34, ll. 6 – 8; Patent ‘883, col. 38, l. 67 – col. 39, l. 4.) They further note that the “effect of dietary NaCl to increase serum calcium levels likely occurs because the fish is obligated to excrete this excess NaCl that it has ingested” and “[i]ngestion of this excess NaCl activates the fish’s drinking behavior thereby causing it to ingest water mixture containing 3 mM calcium and thereby increases its body fluid calcium content via the intestinal absorption of calcium.” (*E.g.*, Patent ‘379, col. 34, ll. 39 – 46; Patent ‘883, col. 39, ll. 36 – 42.)⁴⁶

⁴⁵ Example 7 in the specifications also teaches that additions of PVCR modulator to the freshwater without use of the 1% NaCl feed, or use of the 1% NaCl feed without additions of the PVCR modulator to the freshwater will not achieve these results. (Patent ‘379, col. 34, ll. 9 – 16, 46 – 50; Patent ‘792, col. 39, ll. 16 – 23, 53 – 58; Patent ‘883, col. 39, ll. 5 – 12, 42 – 46; Patent ‘747, col. 48, ll. 58 – 65, col. 49, ll. 27 – 32.)

⁴⁶ According to Dr. Bradley, the data relied on in Example 7 actually relate to studies of blood plasma rather than serum. (Bradley Declaration ¶ 23, PageID # 3552 – 53.) Dr. Jury maintains that the “difference between plasma and serum is not relevant to the results ... because plasma and serum both contain the same electrolytes, including calcium and magnesium,” and because a person of ordinary skill in the art could elect to measure PVCR levels in either plasma or serum. (Jury Declaration ¶ 22, PageID # 970.) This distinction is not material to the conclusions set forth herein.

Plaintiffs' argument in favor of importing a statistical term into its claims is based on findings described in Example 7 of the patents. The patentees write that a "representative experiment" using APS Process I produced serum calcium "[v]alues at 24 hr and 72 hr [considered] significantly ($p < 0.05$) increased as compared to the value at time zero." (E.g., Patent '792, col. 39, ll. 37 – 39; Patent '747, col. 49, ll. 12 – 14.) Citing this example, Plaintiffs contend that claim language referencing "an amount of NaCl sufficient to contribute to a significantly increased level" of PVCR modulator in serum implies statistical significance measured as $p < 0.05$.

Based on a review of the patents and the specifications, a person of ordinary skill in the art would not necessarily understand that the amount of NaCl sufficient to contribute to a "significantly increased level" of PVCR modulator in fish serum would produce a certain statistical measurement of significance. Instead, such a person would more likely understand that practicing the methods described in the patents (i.e., introducing the specified PVCR modulator additions and the specified feed) will produce an increase in the level of PVCR modulator in the serum of treated fish, which when combined with an increase in expression of PVCR in tissue, will result in an increased preparedness for transfer to seawater. In other words, as is the case with increases in PVCR gene expression, a person of ordinary skill in the art would understand that increases in the level of PVCR modulator in serum is evidence that the patented methods are working as taught.

If the Court were to adopt Defendants' argument for indefiniteness, the Court would have to conclude that for the patent to be valid, the increased level of calcium, magnesium, or other PVCR modulator in the serum of treated fish must be precisely quantifiable. Defendants thus focus on the verification of results rather than whether the scope of the claimed invention is

reasonably definite.⁴⁷ Defendants’ argument that the NaCl measurement terms are indefinite is unpersuasive.

A person of ordinary skill in the art would understand that the objective of the methods taught is not to obtain a specific degree of elevation in serum levels, but to obtain an increase in serum levels alongside an increase in PVCR expression.⁴⁸ One skilled in the art thus would be able to “practice the claimed invention without undue experimentation,” *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1244 (Fed. Cir. 2003), including without conducting undue experimentation subject to statistical analysis.⁴⁹ The claim term “significantly increased level” is, therefore, a reasonably definite reference to the increase said to result from the presence of NaCl in fish feed in the amount of at least about 1% by weight, when used in combination with one or

⁴⁷ Defendants assert that the presence of a statistically significant finding would not tend to prove that the methods had any actual biological effect, in part because the blood chemistry of untreated fish is not static and there is no specific amount of increase said to result from the patented methods. (Plaintiffs’ Opening Brief at 27 – 29, PageID # 945 – 47, citing Jury Declaration ¶ 30, PageID # 974.)

⁴⁸ In other words, for the purported invention to work, it is not taught that serum levels must achieve a specific measure, but that an increase in serum levels will coincide with increased expression of PVCR. If the purpose of the invention were to produce a fish with a specific serum level, perhaps Defendants’ argument would be more persuasive. *See, e.g., Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 789 F.3d 1335, 1338 (Fed. Cir. 2015) (involving a patented method of producing a copolymer having a specific molecular weight, found to be indefinite because the patent did not define molecular weight, where three different possible means of measuring molecular weight would produce copolymers having different characteristics).

⁴⁹ Plaintiffs assert, persuasively, that scientists such as the parties’ experts are accustomed to performing statistical analyses on sets of data and generally consider $p < 0.05$ to represent a statistically significant threshold. (Plaintiffs’ Responsive Brief at 14 – 15; Jury Declaration ¶ 18, PageID # 969; Bradley Deposition at 241, PageID # 1527.) However, it does not follow that this limitation is inherent in the patentees’ use of the “significantly increased level” term in the representative claims. Rather, a person of ordinary skill in the art would regard the $p < 0.05$ reference in Example 7 as a representation regarding the reliability of the findings set forth in Example 7. That is, although a statistician or scientist with appropriate training could analyze data obtained by a person of ordinary skill in the art who practiced the disclosed methods, the mere fact that the data are found statistically significant would not determine whether or not the practice of the methods were within the scope of the patents.

more PVCR modulators (e.g., calcium and/or magnesium) added to the freshwater in the concentrations specified.⁵⁰

CONCLUSION

Based on the foregoing analysis, I recommend that the Court deny Defendants' Motion to Strike Plaintiffs' New Proposed Claim Construction (ECF No. 105),⁵¹ and that as set forth below, the Court define the person of ordinary skill in the art, construe the preamble language as limiting in part, and construe the representative claims:

Person of ordinary skill in the art

The person of ordinary skill in the art is a person with, minimally, a bachelor's degree in the biological sciences, whose educational background has been developed by managerial responsibility at a fish hatchery that raises anadromous fish for transfer to seawater, who understands the growth cycle of anadromous fish and the biological and chemical factors that produce osmotic stress in anadromous fish following transfer to seawater, and who has sufficient skill to conduct one or more tests to measure PVCR expression in the tissue of fish and one or more tests to measure PVCR modulator concentrations in fish blood.

Preamble language

The preambles limit the claims to the extent they place the claim steps that follow in the essential context of preparing pre-adult anadromous fish or salmon for transfer to seawater.

The preamble of claim 37 of Patent '747, to the extent it describes the transfer of pre-adult anadromous fish to seawater with a temperature between 14 and 19 degrees Celsius, is not limiting.

⁵⁰ Although the proposed finding is that the claims are not indefinite, in effect the proposed finding is that the claims that describe the amount of NaCl as "an amount ... sufficient to contribute to a significantly increased level" are not thereby made broader in scope than those claims that provide the amount of NaCl by weight.

⁵¹ *See, supra*, note 40.

“Freshwater”

For Patents ‘379 and ‘792 the term “freshwater” means:

- (1) Water from a freshwater source, such as water sourced from a stream, river, pond, or another non-marine source, having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl; and
- (2) Water described in (1) to which has been added calcium and/or magnesium to achieve concentrations in the range of between 2 mM and 10 mM calcium and between 0.5 mM and 10 mM magnesium.

For Patents ‘883 and ‘747 the term “freshwater” means:

- (1) Water from a freshwater source, such as water sourced from a stream, river, pond, or another non-marine source, having, for example, the following ionic composition: less than about 2 mM of magnesium, calcium, and NaCl; and
- (2) Water described in (1) to which has been added a PVCR modulator or more than one PVCR modulator.

“Maintained” in the freshwater

“Maintained in the freshwater” means kept in freshwater for a period of time.

“Polyvalent Cation [Sensing] Receptor” and “PVCR”

“Polyvalent Cation [Sensing] Receptor” or “PVCR” means a sensing receptor in various tissues of anadromous fish, which receptor senses the presence of polyvalent cations both in surrounding water and internally to the fish, which receptor was varyingly described within the relevant art, prior to the patent filing dates, as a G protein-coupled receptor protein, calcium/polyvalent cation-sensing receptor, Ca-sensing receptor, calcium receptor (CaR), aquatic polyvalent cation-sensing receptor, or aquatic PVCR.

“PVCR Modulator”

For Patents ‘379, ‘792, and ‘883 the term “PVCR modulator” means:

A compound that will increase expression of the PVCR, or increase the sensitivity or responsiveness of the PVCR.

For Patent ‘747 the term “PVCR modulator” means:

A compound that increases and/or decreases expression of the PVCR, or the sensitivity or responsiveness of the PVCR.

“PVCR agonist”

For Patents ‘379, ‘792, and ‘883 the term “PVCR agonist” means:

A PVCR modulator that indirectly alters PVCR expression or sensitivity, by stimulating PVCR responsiveness to PVCR modulators (polyvalent cations), that will increase expression of the PVCR or the sensitivity or responsiveness of the PVCR.

For Patent ‘747 the term “PVCR agonist” means:

A PVCR modulator that indirectly alters PVCR expression or sensitivity, by stimulating PVCR responsiveness to PVCR modulators (polyvalent cations), that increases and/or decreases expression of the PVCR or the sensitivity or responsiveness of the PVCR.

“Sensitivity”

“Sensitivity” means sensitivity or responsiveness.

“Expression”

“Expression” means gene expression of the PVCR.

“Magnesium and calcium ... in an amount”

Additions of “magnesium and calcium ... in an amount” means molar concentrations of between about 2.0 and about 10.0 mM calcium and about 0.05 and about 10.0 mM magnesium.

“At least one PVCR modulator ... in an amount”

Additions of “at least one PVCR modulator ... in an amount” means, for example, additions of calcium and/or magnesium at the molar concentration described in the specifications, as well as additions of other polycations and amino acids in the concentrations indicated in the specifications.

**“Sufficient to increase [or modulate] expression and/or sensitivity”
of a PVCR**

Additions made to freshwater that are “sufficient to increase expression and/or sensitivity” of at least one PVCR means, for example, additions of calcium and/or

magnesium at the molar concentration described in the specifications, or additions of other polycations or amino acids in the concentrations indicated in the specifications.

NaCl

For Patents '379, '792, and '883, the term "NaCl" means "a substantially pure compound, and mixtures of NaCl with other sources of sodium."

For Patent '747, the term NaCl means "a substantially pure compound, mixtures of NaCl with other sources of sodium and mixtures of other sources of sodium."

"An amount of NaCl sufficient"

"An amount of NaCl sufficient" means between about 1% and about 10% NaCl content by weight or a NaCl/feed ratio of between about 10,000 mg/kg and 100,000 mg/kg.

"Significantly increased level"

"Significantly increased level" is a term of approximation, which term refers to the increase in the PVCR modulator level in serum taught to result from the presence of NaCl in fish feed in the amount of at least about 1% by weight, when used in combination with one or more PVCR modulators (e.g., calcium and/or magnesium) added to the freshwater in the concentrations specified.

NOTICE

A party may file objections to those specified portions of a magistrate judge's report or proposed findings or recommended decisions entered pursuant to 28 U.S.C. § 636(b)(1)(B) for which *de novo* review by the district court is sought, together with a supporting memorandum, and request for oral argument before the district judge, if any is sought, within fourteen (14) days of being served with a copy thereof. A responsive memorandum and any request for oral argument before the district judge shall be filed within fourteen (14) days after the filing of the objection.

Failure to file a timely objection shall constitute a waiver of the right to *de novo* review by the district court and to appeal the district court's order.

/s/ John C. Nivison
U.S. Magistrate Judge

Dated this 6th day of July, 2016.